One of the major concerns in the behavior of an earth dam is the change in the exit gradient and the impact on the slope stability under drawdown conditions. Drawdown can cause increased seepage forces on the upstream slope which may result in the movement of soil particles in the flow direction and cause erosion problems. In this research, a numerical approach, based on the finite element method (FEM) is used to analyze the seepage through the dam and its foundation to study exit gradients and slope stability under both steady-state and transient conditions. The results show that a central core is important in reducing the flux through the dam. Constructing a cutoff under the core further increases the efficiency of the core and lowers the phreatic line. However, it is seen that the submerged weight increases when the earth dam with a core or with a complete cutoff which causes higher water flux to flow out of the dam under the drawdown condition. The exit gradient at the upstream slope may reach critical levels and cause failure of the dam due to erosion. Adding an upstream filter is studied as a possible solution to this problem. Two configurations of the filters are modeled and the sloping filter configuration performed best in reducing the exit gradient at the upstream face. A low permeability core with a cutoff increases deformation of the soil because of increased saturated areas in the upstream region. The factor of safety of the slope is also reduced because of the increased buoyancy of the soil at the upstream side of the dam. The soil properties of the upstream filter have a significant influence on the slope stability against sliding. An upstream slope filter increases the stability of the slope while a central filter decreases it.

Educational Career:
Bachelor's of Civil Engineering, BS, 2003, University of Kufa
Master's of Civil Engineering - Geotechnical, MS, 2007, University of Kufa

Committee in Charge:
, Chair,

Approved for distribution by , Committee Chair, on October 5, 2018.

The public is welcome to attend.